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IN THE UNITED STATES BANKRUPTCY COURT
FOR THE DISTRICT OF PUERTO RICO

In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of THE COMMONWEALTH OF PUERTO RICO, *et al.* Debtors.[1]	PROMESA Title III Case No. 17 BK 3283-LTS (Jointly Administered)
In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO as representative of PUERTO RICO ELECTRIC POWER AUTHORITY, Debtor.	PROMESA Title III Case No. 17 BK 4780-LTS

REBUTTAL EXPERT DECLARATION OF DR. JOSÉ ISRAEL ALAMEDA LOZADA IN SUPPORT OF THE EMPLOYEES' RETIREMENT SYSTEM OF PUERTO RICO ELECTRIC POWER AUTHORITY'S OBJECTION TO THE CONFIRMATION OF THE PUERTO RICO ELECTRIC POWER AUTHORITY'S PLAN OF ADJUSTMENT

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[1] The Debtors in these Title III Cases, along with each Debtor's respective Title III case number and the last four (4) digits of each Debtor's federal tax identification number, as applicable, are the (i) Commonwealth of Puerto Rico (Bankruptcy Case No. 17 BK 3283-LTS) (Last Four Digits of Federal Tax ID: 3481); (ii) Puerto Rico Sales Tax Financing Corporation ("COFINA") (Bankruptcy Case No. 17 BK 3284-LTS) (Last Four Digits of Federal Tax ID: 8474); (iii) Puerto Rico Highways and Transportation Authority ("HTA") (Bankruptcy Case No. 17 BK 3567-LTS) (Last Four Digits of Federal Tax ID: 3808); (iv) Employees Retirement System of the Government of the Commonwealth of Puerto Rico ("ERS") (Bankruptcy Case No. 17 BK 3566-LTS) (Last Four Digits of Federal Tax ID: 9686); and (v) Puerto Rico Electric Power Authority ("PREPA") (Bankruptcy Case No. 17 BK 4780-LTS) (Last Four Digits of Federal Tax ID: 3747). (Title III case numbers are listed as Bankruptcy Case numbers due to software limitations.)

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Q. State your name.

Dr. José Israel Alameda Lozada.

Q. State on whose behalf you are testifying before the Title III Court.

I am testifying on behalf of the Puerto Rico Electric Power Authority Employee's Retirement System ("PREPA ERS" or "SREAEE").

Q. What additional information did you review in preparation of your rebuttal testimony?

In addition to the materials reviewed in preparation for my direct testimony, I reviewed:

- Expert Testimony of Glenn George.

Q. What is the purpose of your rebuttal testimony?

The purpose of my rebuttal testimony is to establish that Dr. George failed to demonstrate that the principles of ratemaking mentioned in his report were tested or objectively assessed in the design of the ***Legacy Charge***. Dr. George never expresses in a clear manner or comprehensive assessment of whether these eight individual principles were met or how. Moreover, while Dr. George expresses that the ***Legacy Charge*** is consistent with the principles of just and reasonable rates stated by Bonbright in the 1960s, he did not examine the principles updated by Rábago and Valova.

Q. What are the conclusions of your rebuttal testimony?

I conclude that Dr. George shows tremendous optimism regarding the feasibility of the Plan of Adjustment with the ***Legacy Charge***, which is not validated by empirical data. Specifically, in that he concludes that the ***Legacy Charge*** would have minimal if any effect on the economy. On the contrary, I conclude that the ***Legacy Charge*** will hurt Puerto Rico's economy, as shown in my direct testimony. Additionally, I conclude that the ***Legacy Charge*** will reduce PREPA's revenues in the long run.

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Moreover, I conclude that Dr. George failed to demonstrate that the Bonbright principles were tested or objectively assessed in the design of the ***Legacy Charge***. My detailed examination of most of the principles shows that they do not favor the ***Legacy Charge.*** **Annex A.** Moreover, he did not consider the updated principles set forth by Rábago and Valova.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief.

José I. Alameda Lozada, Ph.D.

May 15, 2023

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ANNEX A – REBUTTAL TESTIMONY

The Financial Oversight and Management Board ("FOMB") presented the expert witness testimony of Dr. Glenn George ("Dr. George"). In his testimony ("George Report"), Dr. George addressed the feasibility of the ***Legacy Charge.***

In summary, Dr. George's conclusions are:

1. The ***Legacy Charge*** is *fair and reasonable* and would pay the debt service proposed by the FOMB easily and prudently.
2. The ***Legacy Charge*** would not cause harmful effects on the economy, and if it did cause any, they would be minimal.
3. The ***Legacy Charge*** would not affect future investment needs, i.e. capital expenses ("CapEx") for the Puerto Rico Electric Powe Authority.

Dr. George was asked to study the methodology applied by Brattle Group, Inc. ("Brattle"), under the direction of the FOMB, to derive the ***Legacy Charge*** in the Plan of Adjustment, and provide an opinion on whether:

1. The ***Legacy Charge*** provides PREPA's creditors with reasonable recoveries of their claims, and does not affect PREPA's need to continue operations, nor burden Puerto Rico's economy;

2. The methodology used by Brattle to determine the ***Legacy Charge*** is appropriate; and

3. The design of the ***Legacy Charge*** is consistent with the principles of fair and reasonable rates.

On the other hand, ratemaking for public utilities is predicated on the concept of just and reasonable rates. The definition of just, fair, and reasonable rates is not only about the operational and financial aspect of the public utility. It considers the risk involved when higher rates are imposed. In his report, Dr. George cites that "[o]ne way of determining whether utility rates are just and reasonable is to judge them against the 'attributes of a sound rate structure' articulated by James C. Bonbright in a seminal work in the field of public utility ratemaking."[1] According to Dr. George, these attributes are:

1. Rates should have the following practical attributes: simplicity, understandability, public acceptability, and feasibility of application.
2. Rates should be free from controversies as to proper interpretation.
3. Rates should effectively yield total revenue requirements under the fair return standard.
4. Rates should provide revenue stability from year to year.

[1] *George Report,* ¶ 96.

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5. Rates themselves should be stable, i.e. rates should experience minimal unexpected changes that are seriously adverse to existing customers.
6. Rates should apportion the total cost of service fairly among different consumers.
7. Rate relationships should avoid "undue discrimination."
8. Rates should promote efficiency, discouraging wasteful use of energy while promoting all justified types and amounts of use. [2]

However, many factors, apart from an additional layer of energy charge, are associated with risky operations, not only to local businesses and families but for the public utility itself. All these effects together will hurt the prosperity of the overall economy.

According to Rábago and Valova, Bonbright's *Principles of Public Utility Rates* are often summarized in three categories: (1) revenue requirement; (2) fair apportionment of costs among customers; and (3) optimal efficiency.[3] Rábago y Valova stated:

> When James Bonbright's "Principles of Public Utility Rates" was published in 1961, electric utilities and the environment in which they operated were vastly different. The central station utility model was dominant, and economies of plant scale appeared inexhaustible. In fact, the 1960s marked the zenith of the trend toward large power plants, and since that decade, we have seen a wide range of fundamental changes in the electricity system. These changes include widespread competition in the generation sector, retail competition, the emergence of renewable energy generation, and, most significantly, a revolution in scale that has ushered in an era of distributed energy resources (DER). Bonbright's text did not account for these changes; now, nearly 60 years since the publication of the Bonbright's treatise, it is time for a rewrite.[4]

As customers increasingly seek to generate their own electricity through on-site generation, reduce their load through energy efficiency, and otherwise take more control over their energy usage and bills, utilities are facing challenges that were unimaginable or at least difficult to appreciate when Bonbright articulated the principles for public utility ratemaking. Consequently, Rábago and Valova added the following principles:

1. Regulators should fully comprehend and reflect resource value in rates.
2. Ratemaking must account for the relative market positions of various market actors, and for the information asymmetries among different customers, utilities, and market participants.

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[2] *Ibid.* citing James C. Bonbright, Principles of Public Utility Rates, Columbia University Press, New York NY, 1961, p. 291.

[3] Karl R. Rábago and Radina Valova, Revisiting Bonbright's principles of public utility rates in a DER world. Pace Energy and Climate Center, Pace University Elisabeth Haub School of Law, White Plains, NY, United States. The Electricity Journal 31 (2018) pp. 9–13, https://peccpubs.pace.edu/getFileContents.php?resourceid=43bdf87a9063c34.

[4] Rábago & Valova, *op cit*, p. 9.

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3. Sound rate design must be grounded in a careful assessment of practical economic impact on all market participants, especially customers.
4. Rates must support capital attraction for all resources that provide energy services, regardless of whether the affected investor is the utility, the customer, or a third-party provider.
5. Rates must be designed to account for the incentives they create for utilities, customers, and non-utility market participants.
6. Just and reasonable rates require accurate accounting for utility costs.
7. Rate design and cost allocation are separate functions, driven by distinct policy objectives.

In our opinion, the George Report failed to demonstrate that the updated principles of just, fair, and reasonable rates were tested or objectively assessed in the design of the ***Legacy Charge***. The George Report concludes that "the Legacy Charge and associated Legacy Charge Revenues are consistent with the concept of just and reasonable rates[,]"[5] Dr. George never expresses in a clear manner or comprehensive assessment of whether these eight individual principles were met or how. Moreover, while Dr. George argues that the ***Legacy Charge*** is consistent with the principles of just and reasonable rates stated by Bonbright in the 1960s, he did not examine the principles updated by Rábago and Valova. These updated principles are essential to evaluate the ***Legacy Charge***, as they account for the changes in technology in the past few decades.

Attributes # 1 and #2:

> "Rates should have the following practical attributes: simplicity, understandability, public acceptability, and feasibility of application."
>
> "Rates should be free from controversies as to proper interpretation."

To begin with, the words "simplicity," "understandability," "public acceptability," and "feasibility of application" are subjective. They are based on values of judgment, without any scientific foundation. To offset this value judgement, Dr. George should have considered incorporating logical and empirical validations. However, the George Report is not concerned with defining these terms.

For instance, the meaning of "simplicity" and "understandability" are not included. However, the design of the rate has proven to be far from simple, as public record shows that there have been multiple interpretations of the result of the ***Legacy Charge***, as customers struggle to understand the combination of the three components of the rate and their application per sector.[6]

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[5] *George Report,* ¶ 98.

[6] *Junta Fiscal da paso a un alza de $19 al mes en factura de energía eléctrica*, 09/02/2023, https://jayfonseca.com/junta-fiscal-da-paso-a-un-alza-de-19-al-mes-en-factura-de-energia-electrica/ (stating that the ***Legacy Charge*** is $19); Factura de la luz subirá 30% para pagar pensiones y deuda de la AEE, 10/05/2023, https://jayfonseca.com/factura-de-la-luz-subira-30-para-pagar-pensiones-y-deuda-de-la-aee/ (stating that the rate increase is 30%); *Junta considera cargo en la factura de la luz de $13 para residencias*, 11/05/2023,

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Moreover, the basis for claiming that the ***Legacy Charge*** has "public acceptability" is not expressed.[7] In fact, the public record shows that public acceptability of the ***Legacy Charge*** is strained, among other things by the many announcements of increased rates which create both confusion and resistance:

> In 2016: Act 4-2016 sought to place a "Transition Charge" on the electric bills of all PREPA's customers. The Puerto Rico Energy Bureau ("PREB") approved the Calculation Methodology and Adjustment Mechanism proposed a transition charge of 3.10 ¢/kWh.
>
> In 2019: The Restructuring Support Agreement ("RSA") with the bondholders would have resulted in a Transition Charge. This deeply concerned customers, because it would have resulted in a hike in the cost-per-kWh, over a 50- year horizon, starting at 2.768 ¢/kWh in 2021 and increased to 4.552 ¢/kWh by 2043 and thereafter until debt service were paid.
>
> In 2022: The Plan of Adjustment included the ***Legacy Charge*** for 35 years to allow for sufficient revenues as a source of repayment for the new bonds issued under the Plan of Adjustment. The ***Legacy Charge*** involves both a volumetric component based on customer class and a customer's electricity use, and a flat monthly connection charge, based on customer class.

The Chairman of FOMB, David Skeel, publicly stated that "[e]ach member of the Board is fully aware that this Legacy Charge from PREPA **is painful for Puerto Rico, its residents, and its businesses**."[8] (emphasis added)(our translation). Meanwhile, various organizations have joined forces against the ***Legacy Charge***; creating the campaign "*No Más Aumentos a la Luz*", which translates into "No More Electricity Rate Increases."[9] This campaign has focused on mobilizing citizens to avoid new increases in electricity bills for payment to PREPA bondholders and has raised thousands of signatures, which have been provided to the FOMB.[10] Thus, any

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https://www.noticel.com/ahora/top-stories/20230511/junta-considera-cargo-en-la-factura-de-la-luz-de-13-para-residencias/ (stating that the ***Legacy Charge*** is $13 for residential customers and $800 for commercial customers).

[7] As a resident of Puerto Rico, I can attest that the public discussion on this issue is at best confusing. The population has not been well informed, as there have been conflicting reports of what the proposal for additional rate increases.

[8] *Junta Fiscal da paso a un alza de $19 al mes en factura de energía eléctrica* by Jagual Media. 09/02/2023, https://jayfonseca.com/junta-fiscal-da-paso-a-un-alza-de-19-al-mes-en-factura-de-energia-electrica/.

[9] No más aumento, https://www.nomasaumentos.com/.

[10] Pintan mural en contra de más aumentos a la luz: Es una obra del artista Jesús Delgado Burgos, https://www.metro.pr/noticias/2023/04/01/pintan-mural-en-contra-de-mas-aumentos-a-la-luz/#:~:text="La%20campaña%20No%20Más%20Aumentos%2C%20creada%20por%20el,el%20pago%20a%20los%20bonistas%20de%20la%20AE; Desolador panorama ante aumento en factura de luz: Auguran otra fuga masiva de profesionales al no poder enfrentar el aumento en el costo de vida, https://www.metro.pr/noticias/2023/02/10/desolador-panorama-ante-aumento-en-factura-de-luz/; Gobernador reitera ante la Junta de Supervisión pedido para contrarrestar aumento en costo de combustible (Participa de la 34ta reunión pública del ente federal, https://www.aafaf.pr.gov/wp-content/uploads/Gov-Reiterates-OB-Req-Offset-Increase-Fuel-Cost.pdf; Protestan contra alza de tarifas eléctricas en Puerto Rico, https://www.telesurtv.net/news/puerto-rico-protesta-alza-tarifas-electricas-20220408-0028.html. 8 abril 2022.

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understanding of "public acceptability" by Dr. George is not based on realistic evaluations of public opinion, and ignores the public outcry against the ***Legacy Charge.***

Attribute #3:

"Rates should effectively yield total revenue requirements under the fair return standard."

Dr. George never addressed the issue of a fair return for PREPA, nor provided a calculation of this parameter. Also, he did not provide any calculation of a fair return standard is, or a definition of fair return. On that issue, the seminal work of C.O. Ruggles stated:

> There is no general agreement as to what is meant by fair return, but there appears to be a growing appreciation of the fact that public utilities should be permitted to earn a fair return. It is clear that a fair return would not be the same under all circumstances. Moreover, like a tax rate, the base upon which the return is computed naturally modifies the rate which would be necessary to provide a "fair return." Leaving for later discussion what constitutes a proper base upon which the rate of return should be calculated, consideration may be given, first, to several factors which affect the cost of conducting a public utility, or which constitute elements of risk which must be given attention in determining fair return. [11]

Moreover, the George Report is only focused on residential sectors. However, PREPA's total revenues are not only sourced from the residential sectors. They also come from industrial, commercial, agriculture and government sectors, including central government, municipalities, and federal agencies. Although the residential sector groups the largest percentage of PREPA customers (91.46%), is not the largest consumer of kWh. The largest consumers are commercial and industrial sectors, which account for 55.75% of total consumption of kWh. Residential customers account for 42.24%. On the other hand, industrial and commercial account for 58% of total revenues, while residential only accounts for 39%. [12]

Table 1

	Customers, FY 2022	% Total	Consumption kWh (Mill kWh)	% Total	Average consumption
Agriculture	1,094	0.07%	25	0.15%	23,049
Public Lighting	2,155	0.14%	269	1.65%	124,576
Commercial	123,613	8.29%	7,206	44.27%	58,291
Industrial	591	0.04%	1,869	11.48%	3,164,391
Residential	1,364,229	91.46%	6,875	42.24%	5,040
Total	1,491,684	100.00%	16,278	100.00%	10,912

Note 1 Generación, consumo, costo, ingresos y clientes del sistema eléctrico de Puerto Rico - Datasets - Indicadores.PR. https://indicadores.pr/dataset/generacion-consumo-costo-ingresos-y-clientes-del-sistema-electrico-de-puerto-rico

[11] C. O. Ruggles, Problems of Public-Utility Rate Regulation and Fair Return. Journal of Political Economy, Vol. 32, No. 5 (Oct. 1924), pp. 543-566.

[12] Generación, consumo, costo, ingresos y clientes del sistema eléctrico de Puerto Rico - Datasets - Indicadores.PR. https://indicadores.pr/dataset/generacion-consumo-costo-ingresos-y-clientes-del-sistema-electrico-de-puerto-rico.

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Attribute #4:

"Rates should provide revenue stability from year to year."

Dr. George did not make any comments to support the fact that this attribute is met.

Table 2

Year Natural	Consumption kWh x customer	Total revenue PREPA from residents	Cost per kWh (cents)	Year Bill Paid
2020	5,073	$1,306.61	19.51	$989.54
2021	5,167	$1,473.60	21.02	$1,086.10
2022	4,770	$1,823.22	28.05	$1,337.95
2023 (Jan-Feb)	4,716	$1,147.26	22.79	$1,075.04
Deviation Standard	222.17	289.51	3.72	150.20
Average	4,932	1,438	23	1,122
Coef Variation	4.51%	20.14%	16.30%	13.38%

Note 2 Generación, consumo, costo, ingresos y clientes del sistema eléctrico de Puerto Rico - Datasets - Indicadores.PR. https://indicadores.pr/dataset/generacion-consumo-costo-ingresos-y-clientes-del-sistema-electrico-de-puerto-rico

Table 2 depicts the coefficient of variation ("CV"). CV, as a statistical measure, shows the relative variability of data. The CV is calculated as the ratio of the standard deviation (found in the numerator) to the mean or average (found in the denominator). It shows the extent of variability in relation to the mean of the total population. The CV is useful to understand the level of revenue instability. In Table 2, we can see that the CV for total revenues between 2020 and 2023 was 20.14%, which is higher than the CV for consumption, cost per kWh and Year Bill Paid of energy. Therefore, the degree of variation for revenues is high and the attribute of revenue stability is not validated by the most basic information.

Attributes #6 and #7:

"Rates should apportion the total cost of service fairly among different consumers."

"Rate relationships should avoid 'undue discrimination.'"

These attributes will be assessed jointly in the following analysis.

According to Dr. George, the Revenue Envelope Model, which fixed the upper bound at 6%, is affordable for residential customers in Puerto Rico without causing any decrease in welfare levels.

> The Oversight Board relied on the Revenue Envelope Model to estimate the upper bound of incremental revenues—in addition to the revenue requirements defined in the 2022 Fiscal Plan—while remaining within certain economic and societal limitations. This upper bound on revenue is known as the *"Revenue Envelope."* The Revenue Envelope Model estimates the fixed and volumetric charges required to generate the Revenue Envelope over a 28-year forecast period (the same period used in the 2022 Fiscal Plan). To estimate the Revenue Envelope, the Oversight Board took into consideration a **number of factors, including customers' willingness and ability to pay higher rates,** and the future sustainability of PREPA as a going concern. The Revenue Envelope represents the upper bound on revenue which

could reasonably be available for debt repayment, capital expenditures, and other prudent PREPA expenses. (emphasis added). [13]

However, it should be noted that the George Report did not depict any survey, or comprehensive study to support the willingness or ability of customers to pay the rate hikes. Dr. George simply assumes this factor when it is of such paramount importance. There is no analysis of cost of living, poverty levels, geographical differences amongst customers, nor other factors that should have been considered. The FOMB used a threshold payment of 6% share of wallet ("SOW") of Median Household Income. If the 2021 Median Household Income is $21,967, then an upper bound of incremental is $1,318. For 2024 (expected year for ***Legacy Charge*** start), if projected median income is $24,000 (plus 9.3% inflation value), the upper bound is $1,440.

Regarding the median household income in Puerto Rico, in comparison to the states of the United States, Dr. George stated: "Moreover, the Census Bureau noted that household income reporting in the 2020 Survey may include non-recurring federal income support (e.g., COVID relief and stimulus payments), which would tend to inflate household incomes."[14] However, the Median Household Income is closely related to the poverty level threshold of 2021 and 2022.

Table 3

Year	Median Household Income Puerto Rico	Poverty Level Threshold
2021	$21,967	$21,811
2024	$24,000 a/	$23,842 a/

Note 3 .a/ FOMB inflated 2021 by a 9.255%. Same rate of inflation is applied to Poverty Level.

Table 4

Poverty Thresholds for 2022 by Size of Family and Number of Related Children Under 18 Years
(In dollars)

Size of family unit	Related children under 18 years								
	None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated individual):									
Under 65 years	15,225								
65 years and over	14,036								
Two people:									
Householder under 65 years	19,597	20,172							
Householder 65 years and over	17,689	20,095							
Three people	22,892	**23,556**	**23,578**						
Four people	30,186	30,679	29,678	29,782					
Five people	36,402	36,932	35,801	34,926	34,391				
Six people	41,869	42,035	41,169	40,339	39,104	38,373			
Seven people	48,176	48,477	47,440	46,717	45,371	43,800	42,076		
Eight people	53,881	54,357	53,378	52,521	51,304	49,760	48,153	47,745	
Nine people or more	64,815	65,129	64,263	63,536	62,342	60,699	59,213	58,845	56,578

Source: U.S. Census Bureau, 2023.
Note: The source of the weighted average thresholds is the 2023 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).

[13] *George Declaration,* ¶ 32.
[14] *Ibid.*, ¶ 37 f.n. 32.

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Table 5

Poverty Thresholds for 2021 by Size of Family and Number of Related Children Under 18 Years

(In dollars)

Size of family unit	Weighted average thresholds	Related children under 18 years								
		None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated individual):	13,788									
Under 65 years	14,097	14,097								
65 years and over	12,996	12,996								
Two people:	17,529									
Householder under 65 years	18,231	18,145	18,677							
Householder 65 years and over	16,400	16,379	18,606							
Three people	21,559	**21,196**	**21,811**	21,831						
Four people	27,740	27,949	28,406	27,479	27,575					
Five people	32,865	33,705	34,195	33,148	32,338	31,843				
Six people	37,161	38,767	38,921	38,119	37,350	36,207	35,529			
Seven people	42,156	44,606	44,885	43,925	43,255	42,009	40,554	38,958		
Eight people	47,093	49,888	50,329	49,423	48,629	47,503	46,073	44,585	44,207	
Nine people or more	56,325	60,012	60,303	59,501	58,828	57,722	56,201	54,826	54,485	52,386

Source: U.S. Census Bureau, 2022.

Note: The source of the weighted average thresholds is the 2022 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).

Even under the Plan of Adjustment, the ***Legacy Charge*** will only be applied to around 54% of PREPA's residential customers. This is because PREPA already has subsidized residential customers that are exempt from most of the ***Legacy Charge*** and those residential customers under the Commonwealth's Healthcare Programs are also projected to be exempt. Thus, approximately half of residential customers will have to finance the incremental value of the ***Legacy Charge***, and this is over 700,000 households. These households have been hit by higher costs of living *vis a vis* many locations in the United States; as well as the impact of Hurricanes Irma, María (2017) and recently Fiona (2022); Earthquakes; and other calamities.

The ratio of average energy bill relative to median household income in Puerto Rico is higher than any state of United States. This ratio for 2021 was 4.9%; for 2022 was 5.9%; for 2023 was 4.6%; and for 2024, it is 5.0%. Meanwhile, the highest ratios amongst the states are in Mississippi with 3.5%; West Virginia with 3.3% and Alabama with 3.1%. See Table 9.

FOMB and Dr. George base their assumptions on the idea that Puerto Rico's economy is homogeneous, meaning that all the economic sectors, families, and households are under a similar median income, level of wealth, population size and structure, a ratio savings to income, federal social welfare payments, without highly unequal income and wealth distribution, employment, and so on. The analysis on Table 1 (page 12); Table 3 (page 17) and Table 4 (page 22) of the George Report shows that median household income and the 6% of SOW are similar for all households residing at each municipality. This is one of the great pitfalls of the analysis, it constitutes a big fallacy.

The level of economic activity and income is highly concentrated in a few high-income level and metropolitan location sites. Table 6 shows that five (5) out of the seventy-eight (78) municipalities have 44.5% of all establishments in Puerto Rico; generate 49.4% of all jobs; and generate 55.6% of total salaries. These top five municipalities compose 28.9% of Puerto Rico's population. Regarding median household income, the top five municipalities accounted for 29.3% of total households but

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captured 37.1% of total income. The median household income of these top five municipalities is 26.6% higher than the overall median household income for Puerto Rico.

Table 6 Top five municipalities: Establishments, Employees, Total Salaries, and Population 2020

Top 5	Establishments	Employees	Total Salaries	Population 2020
San Juan	10,975	225,806	$8,113,579,805	342,259
Guaynabo	2,483	50,079	$1,837,843,995	89,780
Bayamón	2,899	50,259	$1,349,913,914	185,187
Caguas	2,212	42,820	$1,188,635,802	127,244
Carolina	1,947	41,449	$1,136,613,232	154,815
Top 5	20,517	410,413	$13,626,586,748	899,285
Rest PR	25,598	421,077	$10,899,422,817	2,212,589
Total PR	46,115	831,490	$24,526,009,565	3,111,874
% total Top 5	44.5%	49.4%	55.6%	28.9%

Note 4 Source: Instituto de Estadísticas.

Conversely, at the bottom level, the five municipalities are Ceiba, Vieques, Florida, Las Marías, and Culebra. They have 1.3% of total the population in 2020, and controlled only 0.92% of establishments, generated only 0.61% of jobs and generated only 0.42% of total salaries.[15]

Table 7 Top Five Municipalities and Median Household Income, 2021.

	Col. A	Col. B	Col. C
Top 5	Households, 2017-2021	Median Household Income 2021 prices	Total Household Income
San Juan	142,829	$24,347	$3,477,457,663
Carolina	61,112	$30,678	$1,874,793,936
Bayamón	66,689	$27,812	$1,854,754,468
Caguas	48,226	$27,062	$1,305,092,012
Guaynabo	31,429	$39,176	$1,231,262,504
Sub-Total	350,285	$27,816	$9,743,360,583
Total PR	1,195,195	$21,967	$26,254,848,565
% of Total	29.3%	126.6%	37.1%

Note 5 Source: Median Household Income (2021 prices) and Households, U.S. Census

Table 8

Median HH Income Classes		Municipios	% of Total	Average income	Average Bill Paid	Monthly Bill $	% Cost Energy/MHI
$14,000	$19,999	23	29.5%	$17,810	$1,319	$110	7.4%
$20,000	$23,999	35	44.9%	$21,880	$1,422	$118	6.5%
$24,000	$29,999	13	16.7%	$26,354	$1,841	$153	7.0%
$30,000	over	7	9.0%	$35,106	$2,115	$176	6.0%
		78	100.0%	$24,000	$1,614	$135	6.7%

Note 6 Median Household Income (2021 prices) and Households, U.S. Census

[15] Source: Instituto de Estadísticas.

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Table 10 shows the median household income and the cost of kWh paid per household in a given municipality. It is clear that Puerto Rico pays a higher cost of kWh relative to median income than any of the states. However, in many municipalities, the cost of kWh relative to median income exceeded the 6% ratio. A total of fifty-six (56) out of the seventy-eight (78) municipalities have a cost of kWh relative to median income over the ratio of 6% already. The cost of electricity is high, not only for the residential sector, but also for industrial and commercial.

Table11 classified the municipalities by median household income at 2024 (inflated by a 9.1% increase since 2021), average income, cost of kWh by year and month, and percentage of the cost of energy relative to average median income. Low-income municipalities paid higher energy bills than the those classified at the high-level of income. For instance, the twenty-three (23) municipalities at the median income level of $14,000 to $19,999, pay $110.00. This constitutes 7.4% of income. On the other hand, those municipalities ranked at the top seven (7), with a median income of $30,000 and over, pay $176.00. This constitutes 6% of income. Meanwhile, outliers such as Vieques and Culebra exhibit higher percentages probably due to their role induced by the economy of visitors, in which, the consumption of energy is relatively high due to the consumption of non-residents. Such situations result in a spread value that ranges from 15.9% of income in Vieques to 3.4% of income in Maricao.

Dr. George and the FOMB fail to understand that Puerto Rico is heterogenous. Its population has different incomes and energy payments; it deviates from the $24,000 median income and SOW of 6% or a $120 monthly payment as an upper bound of cash which can reasonably be made available, according to them. However, Tables 10 and 11 show a different story when income distribution is taken into account.

This analysis shows that the ***Legacy Charge*** creates an unduly discriminatory rate, which burdens a class of residential customers with the biggest portion of the total cost of service, on top of double digit cost of living inflation, especially in food and gas prices and other sources of energy. While the intent to exempt low income sectors is admirable, the result is overwhelmingly prejudicial to the non-exempt customers.

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Table 9 Ratio of Median Household Income by State relative to Average Annual Bill kWh($)

State	MHI 2021	Average Yearly Bill ($)	% of MHI
Mississippi	$46,637	$1,624	3.5%
West Virginia	$46,836	$1,554	3.3%
Alabama	$56,929	$1,773	3.1%
Arkansas	$50,784	$1,485	2.9%
Louisiana	$57,206	$1,576	2.8%
Kentucky	$55,629	$1,496	2.7%
South Carolina	$62,542	$1,664	2.7%
Florida	$59,734	$1,565	2.6%
Georgia	$61,497	$1,609	2.6%
Hawaii	$82,199	$2,134	2.6%
Tennessee	$62,166	$1,571	2.5%
Oklahoma	$60,096	$1,436	2.4%
Texas	$67,404	$1,590	2.4%
Connecticut	$80,958	$1,875	2.3%
North Carolina	$62,891	$1,444	2.3%
Missouri	$63,594	$1,423	2.2%
Arizona	$70,821	$1,577	2.2%
Michigan	$64,488	$1,410	2.2%
Indiana	$70,190	$1,518	2.2%
Ohio	$62,689	$1,347	2.1%
Rhode Island	$74,982	$1,565	2.1%
Delaware	$68,687	$1,427	2.1%
Nevada	$64,340	$1,322	2.1%
South Dakota	$73,893	$1,494	2.0%
Alaska	$81,133	$1,607	2.0%
North Dakota	$68,882	$1,355	2.0%
New Mexico	$53,463	$1,048	2.0%
Virginia	$80,268	$1,570	2.0%
Pennsylvania	$72,627	$1,405	1.9%
New York	$72,920	$1,400	1.9%
Massachusetts	$86,566	$1,637	1.9%
Kansas	$75,979	$1,386	1.8%
California	$81,575	$1,484	1.8%
Iowa	$72,429	$1,315	1.8%
Montana	$64,999	$1,174	1.8%
Vermont	$76,079	$1,310	1.7%
Wisconsin	$69,943	$1,202	1.7%
New Hampshire	$88,841	$1,503	1.7%
Maine	$71,139	$1,193	1.7%
Nebraska	$78,109	$1,296	1.7%
Wyoming	$71,052	$1,162	1.6%
Maryland	$97,332	$1,532	1.6%
Minnesota	$80,441	$1,257	1.6%
Oregon	$81,855	$1,277	1.6%
Idaho	$76,918	$1,172	1.5%
New Jersey	$88,559	$1,348	1.5%
Illinois	$79,253	$1,151	1.5%
Washington	$87,648	$1,194	1.4%
Colorado	$84,954	$1,104	1.3%
District of Columbia	$90,640	$1,109	1.2%
Utah	$87,649	$970	1.1%

Puerto Rico	MHI 2021	Average Yearly Bill ($)	% of MHI
2021	$21,967	$1,086	4.9%
2022	$22,648	$1,338	5.9%
2023	$23,350	$1,075	4.6%
2024	$24,000	$1,209	5.0%

Note 7 Source: U.S. Census

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Table 10 Ratio of Median Household Income to Cost per kWh 2024 (Projection)

		Median Household	Cost kWh 2024	% Cost/MHHI
1	Vieques	$16,325	$2,593	15.9%
2	Culebra	$27,427	$3,803	13.9%
3	Arroyo	$15,966	$1,465	9.2%
4	Guánica	$14,046	$1,237	8.8%
5	Cabo Rojo	$20,301	$1,786	8.8%
6	Dorado	$32,497	$2,819	8.7%
7	Lajas	$17,036	$1,477	8.7%
8	Humacao	$24,507	$2,105	8.6%
9	Comerío	$16,023	$1,370	8.5%
10	Hormigueros	$20,197	$1,653	8.2%
11	Ceiba	$22,668	$1,823	8.0%
12	Mayagüez	$16,936	$1,357	8.0%
13	Isabela	$18,708	$1,493	8.0%
14	Barceloneta	$20,814	$1,659	8.0%
15	Ponce	$19,389	$1,542	8.0%
16	Naguabo	$20,116	$1,553	7.7%
17	Río Grande	$25,870	$1,988	7.7%
18	Cataño	$21,948	$1,677	7.6%
19	Fajardo	$23,709	$1,810	7.6%
20	Salinas	$20,281	$1,539	7.6%
21	Luquillo	$24,272	$1,837	7.6%
22	Santa Isabel	$22,708	$1,699	7.5%
23	Guayama	$19,464	$1,447	7.4%
24	Yauco	$17,966	$1,336	7.4%
25	Patillas	$19,429	$1,439	7.4%
26	Aguadilla	$18,508	$1,360	7.3%
27	Manatí	$21,225	$1,530	7.2%
28	Naranjito	$20,929	$1,497	7.2%
29	Vega Alta	$23,848	$1,682	7.1%
30	Arecibo	$21,098	$1,487	7.0%
31	Sabana Grande	$20,602	$1,435	7.0%
32	Peñuelas	$19,800	$1,371	6.9%
33	Vega Baja	$23,497	$1,619	6.9%
34	Juana Díaz	$23,402	$1,611	6.9%
35	San Germán	$18,018	$1,237	6.9%
36	San Juan	$26,600	$1,821	6.8%
	Total PR	$24,000	$1,614	6.7%
37	Rincón	$27,034	$1,817	6.7%
38	Corozal	$21,070	$1,415	6.7%
39	Aguada	$20,467	$1,374	6.7%
40	San Sebastián	$18,368	$1,218	6.6%
41	Coamo	$21,050	$1,379	6.6%
42	Quebradillas	$20,701	$1,354	6.5%
43	Guaynabo	$42,802	$2,755	6.4%
44	Las Marías	$16,774	$1,065	6.3%
45	Canóvanas	$25,693	$1,629	6.3%
46	Juncos	$24,345	$1,541	6.3%
47	Camuy	$21,572	$1,350	6.3%
48	Orocovis	$17,084	$1,063	6.2%
49	Toa Alta	$30,698	$1,898	6.2%
50	Yabucoa	$18,865	$1,165	6.2%
51	Moca	$19,322	$1,183	6.1%
52	Guayanilla	$20,784	$1,267	6.1%
53	Bayamón	$30,386	$1,848	6.1%
54	Utuado	$17,275	$1,050	6.1%
55	San Lorenzo	$21,129	$1,270	6.0%
56	Las Piedras	$26,730	$1,592	6.0%
57	Añasco	$23,150	$1,367	5.9%
58	Villalba	$22,640	$1,318	5.8%
59	Ciales	$20,747	$1,188	5.7%
60	Hatillo	$22,894	$1,306	5.7%
61	Morovis	$23,597	$1,339	5.7%
62	Toa Baja	$29,048	$1,637	5.6%
63	Adjuntas	$16,732	$938	5.6%
64	Caguas	$29,567	$1,647	5.6%
65	Carolina	$33,517	$1,816	5.4%
66	Barranquitas	$22,168	$1,190	5.4%
67	Florida	$23,476	$1,255	5.3%
68	Maunabo	$23,684	$1,255	5.3%
69	Loíza	$21,349	$1,128	5.3%
70	Jayuya	$18,333	$967	5.3%
71	Cidra	$25,486	$1,329	5.2%
72	Lares	$19,261	$965	5.0%
73	Aguas Buenas	$23,866	$1,184	5.0%
74	Gurabo	$38,753	$1,897	4.9%
75	Trujillo Alto	$37,090	$1,771	4.8%
76	Cayey	$26,028	$1,192	4.6%
77	Aibonito	$23,095	$1,045	4.5%
78	Maricao	$21,002	$709	3.4%

Note 8 Source: U.S. Census. The Median Household Income in 2024 is the value of 2021 inflated by 3.1% per year, according to the methodology performed by the FOMB.

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Table 11 Ratio of Median Household Income to Cost per kWh 2024 (Projection) Ranked by Median Household Income

	Municipality	Median Household Income 2024 prices (MHHI) a/	Cost kWh 2024, year b/	Monthly Paid	% Cost/MHHI
1	Guaynabo	$42,802	$2,755	$230	6.4%
2	Gurabo	$38,753	$1,897	$158	4.9%
3	Trujillo Alto	$37,090	$1,771	$148	4.8%
4	Carolina	$33,517	$1,816	$151	5.4%
5	Dorado	$32,497	$2,819	$235	8.7%
6	Toa Alta	$30,698	$1,898	$158	6.2%
7	Bayamón	$30,386	$1,848	$154	6.1%
8	Caguas	$29,567	$1,647	$137	5.6%
9	Toa Baja	$29,048	$1,637	$136	5.6%
10	Culebra	$27,427	$3,803	$317	13.9%
11	Rincón	$27,034	$1,817	$151	6.7%
12	Las Piedras	$26,730	$1,592	$133	6.0%
13	San Juan	$26,600	$1,821	$152	6.8%
14	Cayey	$26,028	$1,192	$99	4.6%
15	Río Grande	$25,870	$1,988	$166	7.7%
16	Canóvanas	$25,693	$1,629	$136	6.3%
17	Cidra	$25,486	$1,329	$111	5.2%
18	Humacao	$24,507	$2,105	$175	8.6%
19	Juncos	$24,345	$1,541	$128	6.3%
20	Luquillo	$24,272	$1,837	$153	7.6%
	Total PR	$24,000	$1,614	$135	6.7%
21	Aguas Buenas	$23,866	$1,184	$99	5.0%
22	Vega Alta	$23,848	$1,682	$140	7.1%
23	Fajardo	$23,709	$1,810	$151	7.6%
24	Maunabo	$23,684	$1,255	$105	5.3%
25	Morovis	$23,597	$1,339	$112	5.7%
26	Vega Baja	$23,497	$1,619	$135	6.9%
27	Florida	$23,476	$1,255	$105	5.3%
28	Juana Díaz	$23,402	$1,611	$134	6.9%
29	Añasco	$23,150	$1,367	$114	5.9%
30	Aibonito	$23,095	$1,045	$87	4.5%
31	Hatillo	$22,894	$1,306	$109	5.7%
32	Santa Isabel	$22,708	$1,699	$142	7.5%
33	Ceiba	$22,668	$1,823	$152	8.0%
34	Villalba	$22,640	$1,318	$110	5.8%
35	Barranquitas	$22,168	$1,190	$99	5.4%
36	Cataño	$21,948	$1,677	$140	7.6%
37	Camuy	$21,572	$1,350	$112	6.3%
38	Loíza	$21,349	$1,128	$94	5.3%
39	Manatí	$21,225	$1,530	$128	7.2%
40	San Lorenzo	$21,129	$1,270	$106	6.0%
41	Arecibo	$21,098	$1,487	$124	7.0%
42	Corozal	$21,070	$1,415	$118	6.7%
43	Coamo	$21,050	$1,379	$115	6.6%
44	Maricao	$21,002	$709	$59	3.4%
45	Naranjito	$20,929	$1,497	$125	7.2%
46	Barceloneta	$20,814	$1,659	$138	8.0%
47	Guayanilla	$20,784	$1,267	$106	6.1%
48	Ciales	$20,747	$1,188	$99	5.7%
49	Quebradillas	$20,701	$1,354	$113	6.5%
50	Sabana Grande	$20,602	$1,435	$120	7.0%
51	Aguada	$20,467	$1,374	$115	6.7%
52	Cabo Rojo	$20,301	$1,786	$149	8.8%
53	Salinas	$20,281	$1,539	$128	7.6%
54	Hormigueros	$20,197	$1,653	$138	8.2%
55	Naguabo	$20,116	$1,553	$129	7.7%
56	Peñuelas	$19,800	$1,371	$114	6.9%
57	Guayama	$19,464	$1,447	$121	7.4%
58	Patillas	$19,429	$1,439	$120	7.4%
59	Ponce	$19,389	$1,542	$129	8.0%
60	Moca	$19,322	$1,183	$99	6.1%
61	Lares	$19,261	$965	$80	5.0%
62	Yabucoa	$18,865	$1,165	$97	6.2%
63	Isabela	$18,708	$1,493	$124	8.0%
64	Aguadilla	$18,508	$1,360	$113	7.3%
65	San Sebastián	$18,368	$1,218	$101	6.6%
66	Jayuya	$18,333	$967	$81	5.3%
67	San Germán	$18,018	$1,237	$103	6.9%
68	Yauco	$17,966	$1,336	$111	7.4%
69	Utuado	$17,275	$1,050	$88	6.1%
70	Orocovis	$17,084	$1,063	$89	6.2%
71	Lajas	$17,036	$1,477	$123	8.7%
72	Mayagüez	$16,936	$1,357	$113	8.0%
73	Las Marías	$16,774	$1,065	$89	6.3%
74	Adjuntas	$16,732	$938	$78	5.6%
75	Vieques	$16,325	$2,593	$216	15.9%
76	Comerío	$16,023	$1,370	$114	8.5%
77	Arroyo	$15,966	$1,465	$122	9.2%
78	Guánica	$14,046	$1,237	$103	8.8%

a/ inflating 9.025% the value of 2021. Same procedure of FOMB
b/ equals the consumption of FY 2022 times cost kWh of $0.2806

Source LUMA;
Generación, consumo, costo, ingresos y clientes del sistema eléctrico de Puerto Rico - Datasets - Indicadores.PR
https://indicadores.pr/dataset/generacion-consumo-costo-ingresos-y-clientes-del-sistema-electrico-de-puerto-rico.

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Dr. George is of the opinion that "revenue generated from the Legacy Charge represents the upper bound of cash which can reasonably be made available for debt repayment, given the already high burden on PREPA's ratepayers and PREPA's need to continue operations and modernize its system, among other requirements."[16]

While PREPA's revenues are important for the cash flow of the utility, PREPA also has an important role in Puerto Rico's economy and its potential recovery towards sustainable economic growth. It is important to understand that the ***Legacy Charge*** has a harmful effect over all sectors. In the case of the ***Legacy Charge***, if imposed, it will hurt the business sector, affect the welfare of local families, and increase the cost of living, among other depressive effects in a stagnated economy, such as Puerto Rico's. There is plenty of literature supporting the thesis that higher energy prices have perverse effects on economic growth and competitiveness.[17] The interindustry effects of the ***Legacy Charge*** should also be addressed because of how Puerto Rico's economic sector is structured. The harmful effects of rate hikes are transmitted throughout sectors.

Meanwhile, another issue is the decline in population level, due to low fertility and childbirth rates, coupled with net emigration. The information in **Table 14** shows that the total level of the population has been decreasing since 2001, when it reached the value of 3.8 million inhabitants. In fact, it is observed that from 1961 to 2018, net migration has been negative, implying that emigration exceeds immigration. If the total level of the population had consistent increases, it was explained partially by natural growth, that is, more live births than deaths. Using an econometric model, we test the residential customer forecast with the following equation:

$$\text{Resident customers} = f(\text{Resident Customers } (-1), \text{Trend}, \text{Trend}^2)$$

Where:

Dependent variable: Resident customers (number)

Independent variables: Trend values and Resident customers lagged by one year.

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[16] *George Report,* ¶ 14.

[17] Lesson For EPA: Higher Energy Prices Harm People, https://www.instituteforenergyresearch.org/the-grid/lesson-for-epa-higher-energy-prices-harm-people/; Lessons For The Energy Transition From The 2021 Energy Crisis, https://www.weforum.org/agenda/2021/10/energy-transition-risks-crisis/; Impacto De Los Precios De La Energía En La Competitividad Industrial Europea, https://www.totalenergies.es/es/pymes/blog/impacto-precios-electricidad-energia-competitividad-industria-europea#:~:text=En%20conclusi%C3%B3n%2C%20la%20fiscalidad%20de%20los%20precios%20de,impacto%20de%20dichos%20precios%20en%20sus%20costes%20productivos; El encarecimiento de la energía y su impacto en la industria manufacturera: ¿a qué sectores está afectando más?, https://www.caixabankresearch.com/es/analisis-sectorial/industria/encarecimiento-energia-y-su-impacto-industria-manufacturera-sectores; La Evolución De Los Costes Energéticos Y Su Efecto En La Competitividad De La Industria Española, https://academica-e.unavarra.es/handle/2454/40751. See, also, José Alameda-Lozada, El Shock Petrolero de 2014: La caída de los precios del crudo y sus efectos en la economía de Puerto Rico Pablo-Arocena y Ana C. Diaz (2015), https://e.exam-10.com/ekonomika/51363/index.html.

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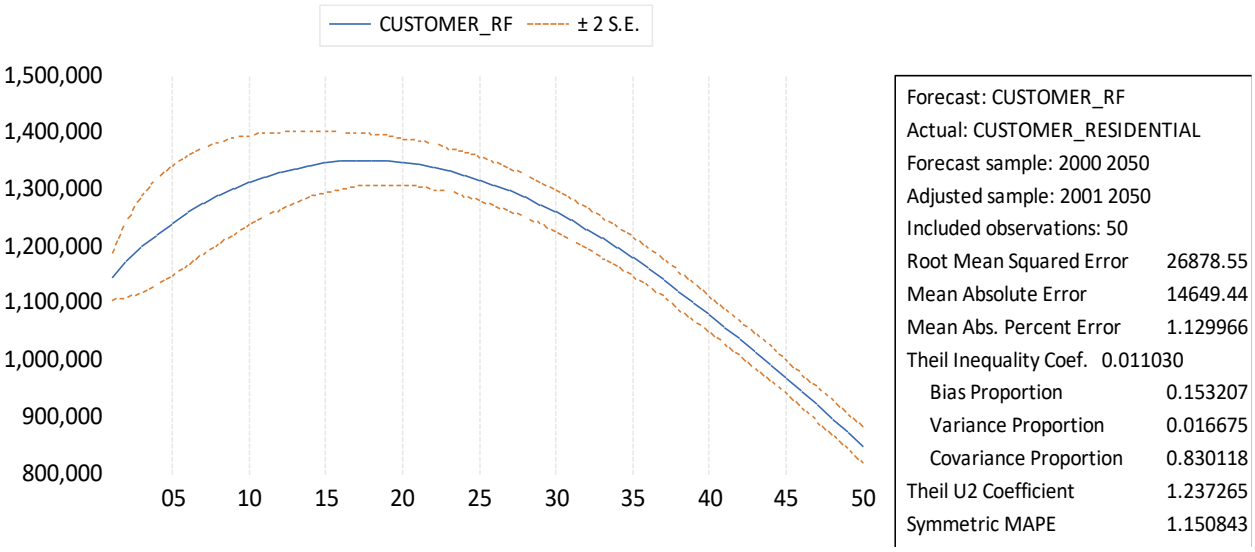
The equation was performed using Dynamic OLS (DOLS) and a cointegrating procedure from E-Views software. The estimated parameters are shown in **Table 12**. The forecast for residential sector customers are shown in **Table 13.** The forecasted value behaved at a negative trend. The expected value of residential customers in 2030 is near 1,261,000; and in 2040 it is 1,080,000.

Table 12 Regression of results of Residential Customer Forecast Equation

Dependent Variable: LOG(CUSTOMER_RESIDENTIAL)
Method: Fully Modified Least Squares (FMOLS)

Sample (adjusted): 2002 2023
Included observations: 22 after adjustments
Cointegrating equation deterministics: C @TREND @TREND^2
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CUSTOMER_RESIDENTIAL (-1))	0.867562	0.240416	3.608592	0.0020
Constant	1.886205	3.370461	0.559628	0.5826
@TREND	-0.003008	0.002882	-1.043765	0.3104
@TREND^2	0.000119	8.84E-05	1.346987	0.1947
R-squared	0.934438	Mean dependent var		14.09804
Adjusted R-squared	0.923510	S.D. dependent var		0.022095
S.E. of regression	0.006111	Sum squared resid		0.000672
Long-run variance	9.23E-05			



Graph 1 Regression of results of Residential Customer Forecast Equation

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Table 13 Residential Customer Forecast results of Residential Customer Forecast Equation

Fiscal Year	Customer Residential	Fiscal Year	Customer Residential
2000	1,115,350	2023	1,374,083
2001	1,235,572	2024	1,328,286
2002	1,252,650	2025	1,319,680
2003	1,269,030	2026	1,310,007
2004	1,285,573	2027	1,299,292
2005	1,303,257	2028	1,287,560
2006	1,314,808	2029	1,274,843
2007	1,317,920	2030	1,261,170
2008	1,314,010	2031	1,246,576
2009	1,323,728	2032	1,231,095
2010	1,335,147	2033	1,214,766
2011	1,340,999	2034	1,197,627
2012	1,340,458	2035	1,179,719
2013	1,353,901	2036	1,161,083
2014	1,332,681	2037	1,141,764
2015	1,327,898	2038	1,121,805
2016	1,327,651	2039	1,101,250
2017	1,335,089	2040	1,080,147
2018	1,339,951	2041	1,058,541
2019	1,344,813	2042	1,036,480
2020	1,341,733	2043	1,014,009
2021	1,349,586	2044	991,175
2022	1,364,229	2045	968,027
		2046	944,609
		2047	920,969
		2048	897,151
		2049	873,202
		2050	849,164

Table 14 Macroeconomic impact of the Legacy Charge in Population Size and Residential Sector

Explanatory Variables	Elasticity to Consumption	2022	2040	Rate of Chg Variables	Consumption kWh 2022: 6,875 mKWh	Changes Consumption M kWh
Customers	1.776626	1,364,229	1,080,147	-20.8%	-37.0%	4,332
Population	1.169212	3,224,189	2,943,829	-8.7%	-10.2%	6,176
Cost kWh (Cents $)						
Plus 1.5 a/	-0.219618	24.3	27.62	13.7%	-3.0%	6,669
Plus 2.0 a/	-0.219618	24.3	28.12	15.7%	-3.5%	6,638
Plus 2.5 a/	-0.219618	24.3	28.62	17.8%	-3.9%	6,607

a/ the forecasted cost per kWh for 2040 is 26.12 cents. See Appendix 1

Note 9 Elasticity values reached using Table 15 equation.

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Table 15 Calculation of Elasticity Value

Dependent Variable: LOG(CONSUMO_RESIDENTIAL__MKWH_)
Method: Fully Modified Least Squares (FMOLS)

Sample (adjusted): 2001 2023
Included observations: 23 after adjustments
Cointegrating equation deterministics: C @TREND @TREND^2
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CUSTOMER_RESIDENTIAL)	1.776626	0.719004	2.470954	0.0244
LOG(COST_KWH_RESIDENTIAL)	-0.219618	0.056649	-3.876847	0.0012
LOG(POPULATION)	1.169212	0.455813	2.565113	0.0201
C	-33.24663	9.908677	-3.355304	0.0038
@TREND	-0.000557	0.00914	-0.06092	0.9521
@TREND^2	0.000195	0.000215	0.90827	0.3764

R-squared	0.691448	Mean dependent var	8.808895
Adjusted R-squared	0.600698	S.D. dependent var	0.06166
S.E. of regression	0.038963	Sum squared resid	0.025808
Long-run variance	0.000681		

The level of residential consumption is not only associated with the cost per kWh but also to the amount of customers and the population size in Puerto Rico. In fact, decreases in residential customers and population levels induce declines in levels of energy consumption more than the cost per kWh does. The analysis performed by FOMB and Dr. George skipped the effects of other relevant macroeconomic variables to support conclusions based upon the long-term capacity of the ***Legacy Charge*** to pay debt service.

Moreover, Dr. George states in his report:

> The Legacy Charge proposed by the Oversight Board was designed to generate the revenues available for debt repayment ("Legacy Charge Revenues") beginning in FY 2024 over a 35-year period, through FY 2058. Specifically, "[t]he Plan of Adjustment specifies that payment of the New Bonds will be funded through an increase in Net Revenues generated through the imposition and collection of a Legacy Charge added to the bills of PREPA's customers [i.e., Legacy Charge Revenues]." (footnotes omitted).[18]

This statement is sustained by FOMB's Legacy Charge Derivation:

> The maximum volumetric charge under the Revenue Envelope calculation was therefore set so that the **resulting electric bill would be affordable**, in the first year of implementation, for non-exempt households with assumed income of $24,000,

[18] *George Report*, ¶ 33.

> monthly volumetric consumption of 425 kWh, and using the rates in the 2022 Fiscal Plan as the baseline, where affordability is defined as a maximum total electricity bill not above 6% of total income. Affordability was set at 6% of total income, or 6% "wallet share," because this 6% energy burden threshold is currently used in several mainland U.S. States as a baseline for providing support to consumers.[19] (footnotes omitted)(emphasis added).

In my direct testimony, I included my study, ***An Assessment of the Legacy Charge Proposed by the Financial Oversight and Management Board: Effects on the Puerto Rican Economy, April 2023***. There, using six (6) equations, I demonstrated that the ***Legacy Charge*** will have a negative effect on the real growth of the Puerto Rican economy in the long term. Moreover, taking all macroeconomic variables into account, the ***Legacy Charge*** will reduce PREPA's revenues in the long run.

Table 16

Fiscal Year	W/O 2.4 cents Revenues to PREPA	With 2.4 cents Revenues to PREPA	Gap
2023	$4,123	4,100	-$23
2024	$4,089	4,037	-$52
2025	$4,017	3,915	-$102
2026	$3,944	3,794	-$151
2027	$3,875	3,679	-$196
2028	$3,807	3,569	-$238
2029	$3,741	3,463	-$278
2030	$3,676	3,360	-$316
2031	$3,613	3,261	-$352
2032	$3,550	3,164	-$386
2033	$3,488	3,070	-$418
2034	$3,428	2,978	-$449
2035	$3,368	2,889	-$478
2036	$3,309	2,803	-$506
2037	$3,251	2,719	-$532
2038	$3,195	2,638	-$556
2039	$3,139	2,560	-$579
2040	$3,085	2,484	-$601
2041	$3,031	2,410	-$621
2042	$2,979	2,339	-$640
2043	$2,927	2,269	-$658
2044	$2,877	2,203	-$674
2045	$2,828	2,138	-$690
2046	$2,779	2,076	-$704
2047	$2,732	2,016	-$717
2048	$2,686	1,957	-$729
2049	$2,641	1,901	-$740
2050	$2,597	1,847	-$750

Note 10 Source: Alameda, José. An Assessment of the Legacy Charge Proposed by the Federal Oversight and Management Board: Effects on the Puerto Rican Economy, April 2023. page 47.

Conclusions

1. The expert witness, Dr. Glenn George, addressed the feasibility of the ***Legacy Charge***. He stated that the ***Legacy Charge*** is fair and reasonable and would pay the debt service proposed by the FOMB easily and prudently. Dr. George shows tremendous optimism, not validated by empirical data, in concluding that there would be no harmful effects on the economy, and if there were

[19] Exhibit P of the Disclosure Statement.

any, they would be minimal. Moreover, Dr. George failed to demonstrate that the Bonbright principles were tested or objectively assessed in the design of the ***Legacy Charge***. Moreover, Rábago and Valova state that these attributes are outdated and the new technologies and changes in the energy sector should be considered.

2. Nonetheless, the economy of Puerto Rico, including commercial, industrial, and residential sectors, will be hurt badly by such a level of rate increases. The ***Legacy Charge*** will be grounded in a weak and stagnated economy. Since 1996, the economy of Puerto Rico has suffered a secular stagnation, exhibiting a weak long run economic rate of growth.

3. In my direct testimony, I found that taking into account many macroeconomic variables, i.e. Real GNP, Human Capital, Demand of energy for residential, commercial, and industrial sector, among others, the PREPA's revenues will suffer in the long-run. The ***Legacy Charge*** has a negative effect on the real growth of the Puerto Rican economy in the long term. It will also affect demand for kWh in industrial sectors, inducing decreased consumption. This decrease translates into fewer revenues for the Commonwealth's general fund, which risks compliance with the debt service obligations of the Commonwealth Plan of Adjustment. Furthermore, the reduction in energy demand will make PREPA's operations unsustainable, particularly when we consider PREPA's new revenue engagements through public-private partnerships, such as those with Luma Energy and GeneraPR.

4. Taking all macroeconomic variables together coupled with all sectors (commercial, industrial, and residential), as a result of the ***Legacy Charge***, PREPA's revenues will suffer in the long run. Including additional charges, PREPA's revenues can be expected to decrease from $4,100 million in 2023 to $2,484 million in 2040.

5. Finally, any increase in rates would result in a cost of energy superior to the upper band of affordability in cost per kWh, as energy costs are already high in Puerto Rico.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief.

José I. Alameda Lozada, Ph.D.

May 15, 2023

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Table 17

CONSUMPTION BY CLASS AND MUNICIPALITY (kWh) FY 2024

HH = Household

MUNICIPIO	Consumption kWh 2022	Cost per kWh, 2024	$ Total Costs 2024	Households, 2017-2021	Median HH Income	Cost year per HH	% Cost/MHHI
Adjuntas	18,746,694	0.2806	$5,260,322	5,611	$15,315	$938	6.1%
Aguada	63,654,867	0.2806	$17,861,556	12,995	$18,733	$1,374	7.3%
Aguadilla	103,941,197	0.2806	$29,165,900	21,442	$16,940	$1,360	8.0%
Aguas Buenas	37,629,244	0.2806	$10,558,766	8,917	$21,844	$1,184	5.4%
Aibonito	32,632,418	0.2806	$9,156,656	8,764	$21,139	$1,045	4.9%
Añasco	43,285,966	0.2806	$12,146,042	8,883	$21,189	$1,367	6.5%
Arecibo	167,578,417	0.2806	$47,022,504	31,624	$19,311	$1,487	7.7%
Arroyo	32,083,945	0.2806	$9,002,755	6,147	$14,614	$1,465	10.0%
Barceloneta	46,402,640	0.2806	$13,020,581	7,847	$19,051	$1,659	8.7%
Barranquitas	37,574,253	0.2806	$10,543,335	8,863	$20,290	$1,190	5.9%
Bayamón	439,320,384	0.2806	$123,273,300	66,689	$27,812	$1,848	6.6%
Cabo Rojo	106,454,472	0.2806	$29,871,125	16,722	$18,581	$1,786	9.6%
Caguas	283,040,777	0.2806	$79,421,242	48,226	$27,062	$1,647	6.1%
Camuy	54,681,887	0.2806	$15,343,737	11,367	$19,745	$1,350	6.8%
Canóvanas	84,819,354	0.2806	$23,800,311	14,612	$23,517	$1,629	6.9%
Carolina	395,601,702	0.2806	$111,005,838	61,112	$30,678	$1,816	5.9%
Cataño	52,079,103	0.2806	$14,613,396	8,716	$20,089	$1,677	8.3%
Cayey	68,062,647	0.2806	$19,098,379	16,022	$23,823	$1,192	5.0%
Ceiba	26,779,275	0.2806	$7,514,265	4,123	$20,748	$1,823	8.8%
Ciales	23,800,486	0.2806	$6,678,416	5,623	$18,990	$1,188	6.3%
Cidra	63,684,320	0.2806	$17,869,820	13,447	$23,327	$1,329	5.7%
Coamo	64,023,043	0.2806	$17,964,866	13,023	$19,267	$1,379	7.2%
Comerío	25,743,390	0.2806	$7,223,595	5,274	$14,666	$1,370	9.3%
Corozal	53,540,963	0.2806	$15,023,594	10,614	$19,285	$1,415	7.3%
Culebra	6,627,765	0.2806	$1,859,751	489	$25,104	$3,803	15.1%
Dorado	118,606,902	0.2806	$33,281,097	11,807	$29,744	$2,819	9.5%
Fajardo	78,419,201	0.2806	$22,004,428	12,158	$21,701	$1,810	8.3%
Florida	19,366,793	0.2806	$5,434,322	4,331	$21,487	$1,255	5.8%
Guánica	24,324,504	0.2806	$6,825,456	5,518	$12,856	$1,237	9.6%
Guayama	72,855,805	0.2806	$20,443,339	14,127	$17,815	$1,447	8.1%
Guayanilla	28,789,853	0.2806	$8,078,433	6,375	$19,023	$1,267	6.7%
Guaynabo	308,585,292	0.2806	$86,589,033	31,429	$39,176	$2,755	7.0%
Gurabo	97,926,457	0.2806	$27,478,164	14,486	$35,470	$1,897	5.3%
Hatillo	63,447,506	0.2806	$17,803,370	13,634	$20,955	$1,306	6.2%
Hormigueros	27,586,811	0.2806	$7,740,859	4,682	$18,486	$1,653	8.9%
Humacao	133,161,227	0.2806	$37,365,040	17,749	$22,431	$2,105	9.4%
Isabela	79,001,339	0.2806	$22,167,776	14,846	$17,123	$1,493	8.7%
Jayuya	17,253,149	0.2806	$4,841,234	5,004	$16,780	$967	5.8%
Juana Díaz	87,790,160	0.2806	$24,633,919	15,287	$21,420	$1,611	7.5%
Juncos	71,734,064	0.2806	$20,128,578	13,065	$22,283	$1,541	6.9%
Lajas	40,882,911	0.2806	$11,471,745	7,765	$15,593	$1,477	9.5%
Lares	33,983,137	0.2806	$9,535,668	9,882	$17,629	$965	5.5%
Las Marías	10,225,868	0.2806	$2,869,379	2,695	$15,353	$1,065	6.9%
Las Piedras	68,458,179	0.2806	$19,209,365	12,068	$24,466	$1,592	6.5%
Loíza	35,078,152	0.2806	$9,842,929	8,727	$19,541	$1,128	5.8%
Luquillo	44,535,949	0.2806	$12,496,787	6,803	$22,216	$1,837	8.3%
Manatí	79,067,078	0.2806	$22,186,222	14,500	$19,427	$1,530	7.9%
Maricao	4,771,797	0.2806	$1,338,966	1,888	$19,223	$709	3.7%
Maunabo	17,409,541	0.2806	$4,885,117	3,891	$21,678	$1,255	5.8%
Mayagüez	141,419,871	0.2806	$39,682,416	29,241	$15,501	$1,357	8.8%
Moca	56,125,300	0.2806	$15,748,759	13,315	$17,685	$1,183	6.7%
Morovis	46,055,658	0.2806	$12,923,218	9,654	$21,598	$1,339	6.2%
Naguabo	45,155,693	0.2806	$12,670,688	8,160	$18,412	$1,553	8.4%
Naranjito	44,277,266	0.2806	$12,424,201	8,302	$19,156	$1,497	7.8%
Orocovis	25,864,707	0.2806	$7,257,637	6,828	$15,637	$1,063	6.8%
Patillas	30,090,358	0.2806	$8,443,354	5,869	$17,783	$1,439	8.1%
Peñuelas	33,002,844	0.2806	$9,260,598	6,756	$18,123	$1,371	7.6%
Ponce	285,827,331	0.2806	$80,203,149	52,008	$17,747	$1,542	8.7%
Quebradillas	39,870,983	0.2806	$11,187,798	8,261	$18,947	$1,354	7.1%
Rincón	36,928,814	0.2806	$10,362,225	5,704	$24,744	$1,817	7.3%
Río Grande	110,338,852	0.2806	$30,961,082	15,573	$23,679	$1,988	8.4%
Sabana Grande	35,120,546	0.2806	$9,854,825	6,868	$18,857	$1,435	7.6%
Salinas	53,624,964	0.2806	$15,047,165	9,778	$18,563	$1,539	8.3%
San Germán	50,599,926	0.2806	$14,198,339	11,475	$16,492	$1,237	7.5%
San Juan	926,880,740	0.2806	$260,082,736	142,829	$24,347	$1,821	7.5%
San Lorenzo	61,438,371	0.2806	$17,239,607	13,571	$19,339	$1,270	6.6%
San Sebastián	59,901,681	0.2806	$16,808,412	13,803	$16,812	$1,218	7.2%
Santa Isabel	43,946,486	0.2806	$12,331,384	7,258	$20,784	$1,699	8.2%
Toa Alta	149,176,951	0.2806	$41,859,052	22,055	$28,098	$1,898	6.8%
Toa Baja	163,376,754	0.2806	$45,843,517	28,002	$26,587	$1,637	6.2%
Trujillo Alto	151,645,885	0.2806	$42,551,835	24,022	$33,948	$1,771	5.2%
Utuado	37,850,752	0.2806	$10,620,921	10,111	$15,812	$1,050	6.6%
Vega Alta	72,804,306	0.2806	$20,428,888	12,146	$21,828	$1,682	7.7%
Vega Baja	114,252,392	0.2806	$32,059,221	19,799	$21,507	$1,619	7.5%
Vieques	21,936,613	0.2806	$6,155,414	2,374	$14,942	$2,593	17.4%
Villalba	36,750,751	0.2806	$10,312,261	7,823	$20,722	$1,318	6.4%
Yabucoa	49,411,772	0.2806	$13,864,943	11,905	$17,267	$1,165	6.7%
Yauco	56,342,806	0.2806	$15,809,791	11,836	$16,444	$1,336	8.1%
Total	6,875,070,253	0.2806	$1,929,144,713	1,195,195	$21,967	$1,614	7.3%

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Appendix

Forecasting costs per kWh for Industrial, Commercial and Residential Puerto Rico Energy Power Authority (PREPA)

The first step relies upon the estimation of cost per kWh with and without the TC. The time frame considered is from historical 2000 to 2019 and forecast for 2022 to 2050. The basic regression equation is:

Cost –per- kWh (cents) = *f* (West-Texas Intermediate (2022 price), Henry Hubb Gas price (2022 prices)).

The two independent variables are:

- West-Texas Intermediate (2022 price);
- Henry Hubb Gas price (2022 prices).

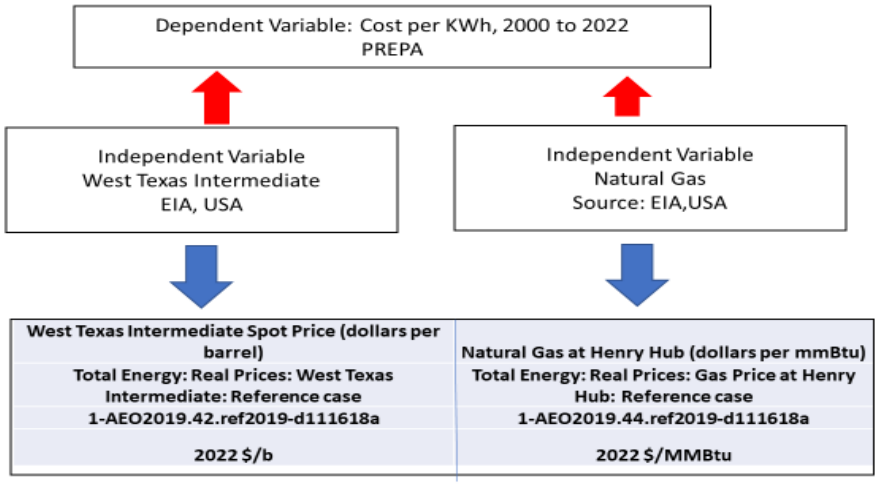
Source: https://www.eia.gov/outlooks/aeo/data/browser/#/?id=62-AEO2023&cases=ref2023&sourcekey=0

The dependent variable is:

- Cost-per-kWh from PREPA per sector.

Source: https://www.aeepr.com/aeees/estadisticas.asp

In 2020, PREPA's net generation was mainly based on oil derived fuels by 70% and natural gas by near 30%. Therefore, the cost equation must take into account both fuel inputs. Notwithstanding, in the future, this will be biased toward natural gas. Then the model will be as follow:



The equation of cost shall be tested as follows:

- Costs per kWh (cents) = f (West-Texas Intermediate (2022 price), Henry Hubb Gas price (2022 prices).
- The Costs per kWh (cents) are for industrial, commercial, and residential sectors.

Each equation will be tested on the time series procedure of Cointegration Fully Modify OLS (FMOLS).

Several authors have claimed that cointegration, either Dynamic OLS (DOLS) or Fully Modified OLS (FMOLS) are both superior to the traditional statistical OLS: (1) OLS estimates are super- consistent, but the t-statistic obtained without stationary, or I(0) terms are only approximately normal.[20]

FMOLS is a non-parametric approach used to deal with serial correlation found at time series data. Dynamic OLS (DOLS) is an alternative (parametric) approach in which lags and leads are introduced to cope with the problem regardless of the order of integration and the existence or absence of cointegration. Either DOLS or FMOLS are usually preferred to the OLS estimator because they take care of small sample bias but also the endogeneity bias by taking the leads and lags of the first-differenced regressors.

The different results are shown below. These results show different scenarios about the future cost of kWh in the industrial, commercial, and residential sectors.

[20] *Purchasing power parity-symmetry and proportionality: Evidence from 116 countries*. Augustine C. Arize a, John Malindretos, and Dilip Ghosh. International Review of Economics and Finance.See https://www.sciencedirect.com/science/article/abs/pii/S1059056014001956; *Exchange-Rate Volatility and Foreign Trade: Evidence from Thirteen LDC's*. Augustine C. Arize, Thomas Osang and Daniel J. Slottje. Vol. 18, No. 1, January 2000. Journal of Business & Economic Statistics. American Statistical Association. pp. 10-17.

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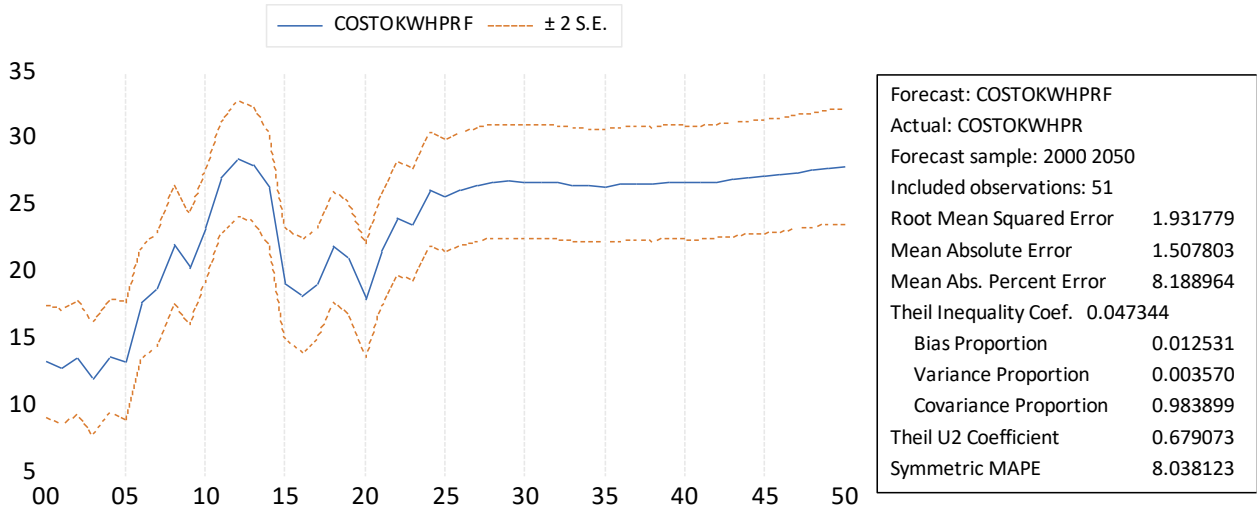
Forecasting the Total Cost per kWh

Dependent Variable: COSTOKWHPR
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 21:05
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL GAS AT HENRY HUB	-1.225778	0.177695	-6.898213	0.0000
WEST TEXAS INTERMEDIATE SPO...	0.206758	0.014401	14.35668	0.0000
C	12.48650	1.097984	11.37220	0.0000

R-squared	0.843837	Mean dependent var	20.06718
Adjusted R-squared	0.827399	S.D. dependent var	4.923617
S.E. of regression	2.045531	Sum squared resid	79.49977
Long-run variance	2.400682		

Figure 1



Graph 2

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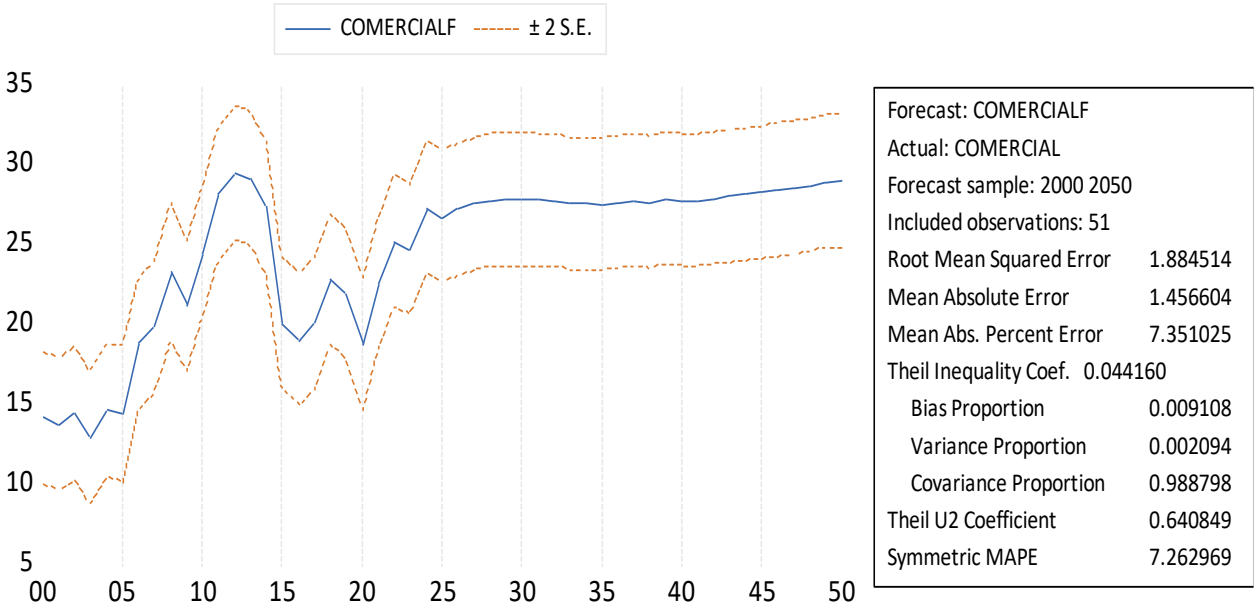
Forecasting Commercial cost

Dependent Variable: COMERCIAL
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 20:48
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL GAS AT HENRY HUB	-1.196160	0.151493	-7.895810	0.0000
WEST TEXAS INTERMEDIATE SPO...	0.210734	0.012278	17.16364	0.0000
C	13.03520	0.936081	13.92530	0.0000

R-squared	0.852526	Mean dependent var	21.02118
Adjusted R-squared	0.837002	S.D. dependent var	5.000733
S.E. of regression	2.018947	Sum squared resid	77.44679
Long-run variance	1.744894		

Figure 2



Graph 3

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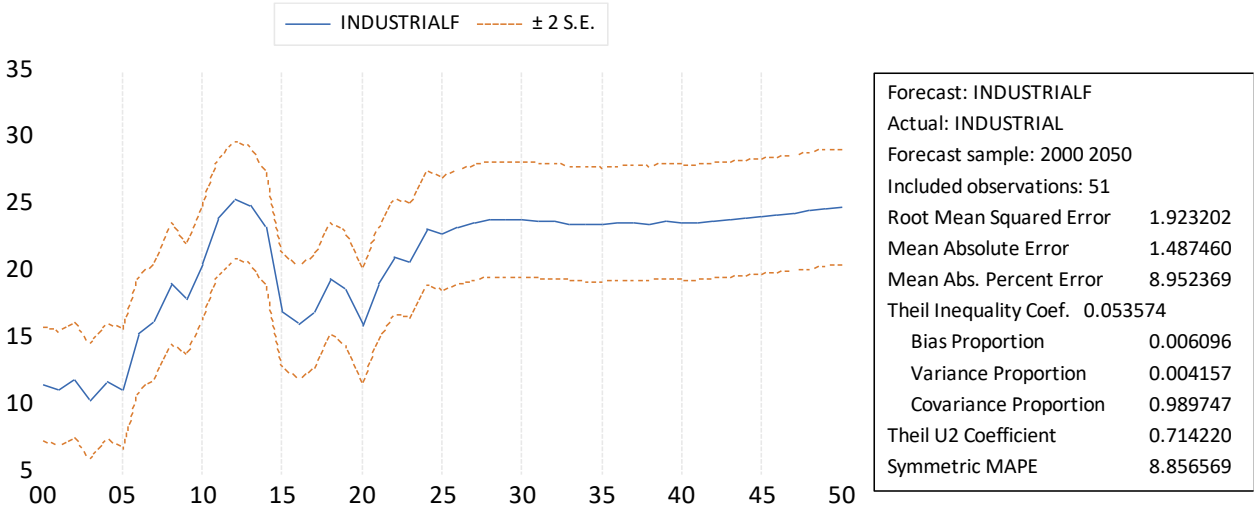
Forecasting Industrial cost

Dependent Variable: INDUSTRIAL
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 20:45
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WEST TEXAS INTERMEDIATE SPO...	0.186880	0.015584	11.99181	0.0000
NATURAL GAS AT HENRY HUB	-1.197609	0.192285	-6.228304	0.0000
C	11.14808	1.188136	9.382831	0.0000

R-squared	0.812453	Mean dependent var	17.63286
Adjusted R-squared	0.792711	S.D. dependent var	4.529738
S.E. of regression	2.062345	Sum squared resid	80.81207
Long-run variance	2.811089		

Figure 3



Graph 4

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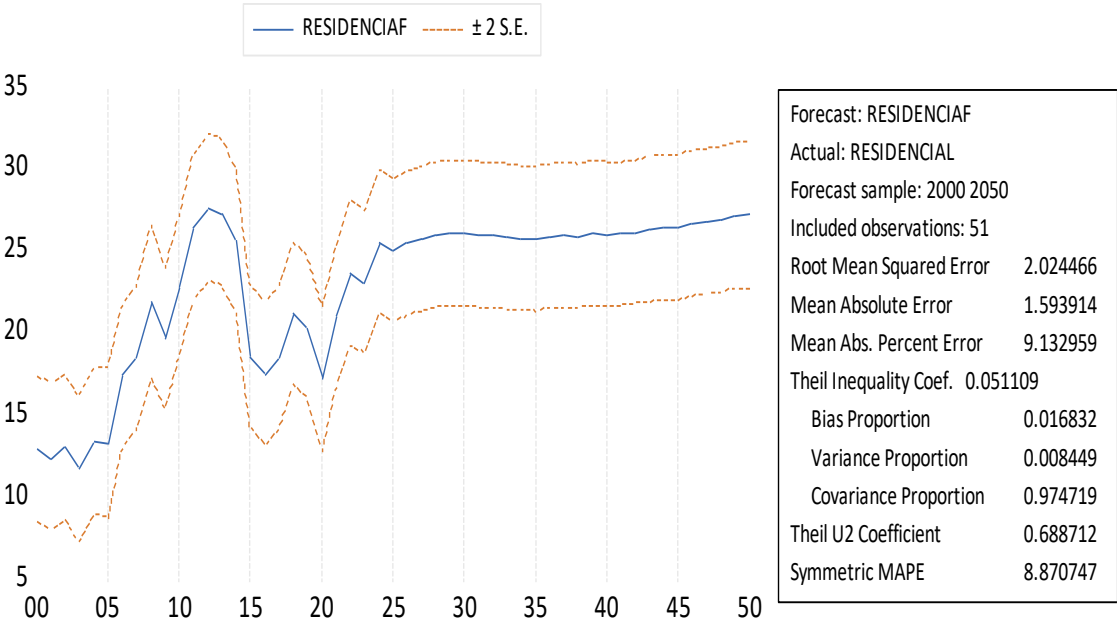
Forecasting Residential cost

Dependent Variable: RESIDENCIAL
Method: Fully Modified Least Squares (FMOLS)
Date: 04/07/23 Time: 20:51
Sample (adjusted): 2001 2022
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NATURAL GAS AT HENRY HUB	-1.123928	0.195472	-5.749810	0.0000
WEST TEXAS INTERMEDIATE SPO...	0.204053	0.015842	12.88026	0.0000
C	11.61968	1.207830	9.620294	0.0000

R-squared	0.828398	Mean dependent var	19.46130
Adjusted R-squared	0.810334	S.D. dependent var	4.861562
S.E. of regression	2.117240	Sum squared resid	85.17140
Long-run variance	2.905054		

Figure 4



Graph 5

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Table 18 Forecast Cost per kWh in Puerto Rico (cents of a dollar)

Fiscal Years	Total Cost kWh	Commercial Cost kWh	Industrial Cost kWh	Residential Cost kWh
2023	23.77	24.81	20.87	23.20
2024	26.34	27.38	23.31	25.64
2025	25.83	26.82	22.90	25.09
2026	26.36	27.33	23.41	25.57
2027	26.67	27.65	23.72	25.87
2028	26.89	27.86	23.92	26.08
2029	26.96	27.93	23.97	26.14
2030	26.94	27.92	23.95	26.14
2031	26.90	27.89	23.90	26.10
2032	26.85	27.85	23.85	26.08
2033	26.69	27.69	23.68	25.93
2034	26.64	27.65	23.62	25.89
2035	26.59	27.60	23.56	25.85
2036	26.74	27.76	23.70	26.00
2037	26.81	27.83	23.76	26.08
2038	26.73	27.76	23.67	26.01
2039	26.93	27.96	23.87	26.20
2040	26.84	27.87	23.77	26.12
2041	26.84	27.88	23.76	26.13
2042	26.94	27.98	23.85	26.23
2043	27.10	28.14	24.00	26.38
2044	27.23	28.27	24.12	26.51
2045	27.31	28.35	24.19	26.58
2046	27.46	28.51	24.33	26.73
2047	27.60	28.64	24.46	26.86
2048	27.77	28.81	24.61	27.03
2049	28.00	29.04	24.83	27.25
2050	28.06	29.11	24.89	27.31

Note 11 The standard error is close to 2.0. Estimates should be within ± 4 cents.